GUARD RAIL AND GUARD CABLE MATERIALS
FIELD SECTION 1040

1040.1 SCOPE. To establish procedures for the inspecting, sampling, accepting, and reporting of guard rail and guard cable materials.

1040.2 APPARATUS.

(a) Scales accurate to within 0.5 percent of the weight [mass] of the sample to be weighed.

(b) Magnetic Gauge, reading range 0-40 mils [0-1000 µm].

(c) Micrometer or vernier caliper capable of measuring to 0.0001 in.[0.00254 mm] and accurate to within at least 0.001 in. [0.0254 mm].

(d) Rule with suitable graduations to accurately measure the material to be inspected.

(e) Fiber reinforced strapping tape.

1040.3 PROCEDURE.

1040.3.1 Guard Rail Beam and Related Sheet Items. Guard rail beams, end sections, buffer ends, end shoes, back-up plates and related steel sheet items may be accepted on the basis of Brand Registration and Guarantee when furnished by those fabricators who have filed an acceptable Brand Registration and Guarantee, as listed in Field Section 1040 Table 1 of this Manual. If the guardrail fabricator has not filed an acceptable Brand Registration and Guarantee, an acceptable mill test report or certification will be required. Regardless of the type of documentation furnished, field inspection performed shall include examination of mill test reports or certifications, if not accepted on Brand Registration and Guarantee; checking identification markings and fabrication; determination of thickness, weight [mass] of coating, and dimensions. Samples shall be submitted to the Laboratory when requested by *Construction and Materials*, or when field inspection indicates questionable compliance with the specifications. When samples are taken, they are to be taken at the frequency and of the size shown in Field Section FS-1040 Table 2 of this Manual.

1040.3.1.1 An acceptable mill test report is to include the quantity of each item; thickness; heat number; results of tests for yield, tensile and elongation; coating date and results of tests for coating weight [mass]. An acceptable certification is to include a statement certifying that all materials furnished conform to Specification Sec 1040 and its supplements. The certification shall include or have attached, specific results of laboratory tests for all specified physical, chemical, and coating properties as determined from samples taken from the lot or lots of material being furnished.

1040.3.1.2 An examination of the identification markings on beam elements and the identification tags or markings on end sections, buffer ends, end shoes, and back-up plates is to be made to determine if the markings conform to the requirements of Specification Sec 1040.3.12. If material is being inspected for acceptance by Brand Registration and Guarantee, the marking shall be as shown in Field Section FS-1040 Table 1 of this Manual.

1040.3.1.3 Field measurement of thickness on beams and sheet items is to be taken on at least

10 percent of the lots furnished. After a lot has been selected for measurement of thickness, pieces shall be selected from that lot for measurement at the rate of one per each 200 pieces in the lot. Thickness measurements are to be made with a micrometer to the nearest 0.0001 in. [2.5 µm] and reported to the nearest 0.001 in. [25 µm] and shall be taken on the tangent portion of the cross section at least 3/8 in.[10 mm] from the edge of the metal across the end of the sheet item. Care is to be taken to avoid drip ends. At least three measurements are to be taken across the end of each piece selected for measurement. The average of all measurements and the minimum single measurement are to be reported. If any measurement is found to be deficient by more than the specified tolerance, double the number of pieces are to be selected from that lot and thickness measurements made. If any measurement taken on the resample pieces fails to comply, the lot of material represented is to be rejected.

1040.3.1.4 Field determination of weight [mass] of coating is to be made, by magnetic gauge, on each lot of material furnished. The magnetic gauge is to be operated and calibrated in accordance with ASTM E376. Specimens for field testing are to be selected from each lot at the frequency shown in Field Section FS-1040 Table 2 of this Manual, but in no case is the number of specimens to be less than three. A single-spot test is comprised of at least five readings of the magnetic gauge taken in a small area and those readings averaged to obtain a single-spot test result. Three such areas should be tested on each side of the specimen being tested. This would yield six single-spot results for that specimen. Test each specimen in the same manner. Average all single-spot test results from all specimens to obtain the average coating weight [mass] to be reported. The minimum single-spot test result would also be selected and reported from all readings. For those items which have a specified coating weight [mass] as the total amount of coating on both sides, the test result that is to be reported should be doubled so the reported test result can be applied directly to the specifications. Material may be accepted or rejected for galvanized coating on the basis of magnetic gauge. If a test result fails to comply with the specifications, that lot should be resampled at double the original sampling rate shown in Field Section FS-1040 Table 2 of this Manual. If any of the resample specimens fail to comply with the specification, that lot is to be rejected. The contractor or supplier is to be given the option of sampling for Laboratory testing, if test results are within minus 15 percent of the specified coating weight [mass].

1040.3.1.5 Dimensions and fabrication are to be field inspected on specimens selected from the lot at the frequency shown in Field Section FS-1040 Table 2 of this Manual. It may be convenient to perform this inspection on the same specimens selected for determining the weight [mass] of coating. Dimensions are to conform to those shown on the Standard drawings. Fabrication should result in a uniform product showing good workmanship.

1040.3.2 Bolts, Nuts, and Washers. Bolts, nuts, and washers intended for use in beam connections and splices may be accepted by Brand Registration Guarantee or by an acceptable certification. Regardless of the type of acceptance documentation, field inspection performed shall include an examination of certifications; and testing for weight [mass] of coating and dimensions. It will only be necessary to submit samples to the Laboratory when requested by *Construction and Materials*, or when field inspection indicates questionable compliance. When samples are taken, they are to be taken at the frequency and of the size shown in Field Section FS-1040 Table 2 of this Manual.

1040.3.2.1 Post and splice bolts, nuts, and washers furnished by a fabricator listed in Field Section FS-1040 Table 1 of this Manual require no additional documentation. Those not covered by Brand Registration and Guarantee must be accompanied by a certification or mill test report. Bolts and nuts specified meet the requirements of ASTM A307 shall be

accompanied by a manufacturer's certification statement that the bolts and nuts were manufactured to comply to the requirements of ASTM A307 and galvanized to comply to the requirements of AASHTO M232, or were mechanically galvanized and meet the coating thickness, adherence, and quality requirements of AASHTO M232, Class C.

1040.3.2.2 Markings are not required on bolts and nuts meeting ASTM A307. All bolts and nuts should be identifiable as to type and manufacturer whether the information is shown on a container or on the bolts and nuts.

1040.3.2.3 Field determination of weight [mass] of coating is to be made on each lot of material furnished. Test procedures and conditions of acceptance or rejection shall be as described in paragraph 1040.3.1.4 of this Section with the following modifications. Due to the size and shape of the material being tested, it will only be necessary to obtain a minimum of three readings of the magnetic gauge on a bolt to determine a single-spot test result and at least five readings on a nut or washer. Since the minimum sampling frequency is three bolts or three nuts or three washers, it will always be possible to obtain at least three single-spot test results from which to calculate an average coating weight [mass] and minimum coating weight [mass] for reporting and applying the specification requirements.

1040.3.2.4 Dimensions of bolts, nuts and washers are to be as shown on the Standard Drawings or as specified.

1040.3.3 Guard Rail Posts, Guard Cable Posts, Blocks, Post Connectors Anchor Plates, Bearing Plates, Soil Plates, and Steel Tube for Breakaway Cable Terminal and End Anchor.

1040.3.3.1 Wood posts and blocks are to be inspected and reported in accordance with Field Sec 1050 of this Manual.

1040.3.3.2 Plastic blocks are to be inspected for dimensional requirements shown in the standard plans by randomly sampling and measuring at least 3 blocks. The sampled blocks should also be visually inspected to ensure that the blocks are solid and homogeneous with a uniform texture and that they are reasonably free from cracking, chipping, flaking, peeling or splintering. A manufacturer’s certification stating that the blocks provided are the same as those that were qualified and NCHRP 350 tested shall be furnished at the time of inspection. If the visual inspection identifies a concern with the dimensions or fabrication of the block, the blocks may be rejected, or one of the sampled blocks may be submitted to the lab for confirmation of the results. A block should not be submitted to the lab if in the opinion of the inspector, the failing dimension or fabrication issue is clear and obvious without subjective interpretation and there is no evidence produced during the visual inspection that would indicate that the block might have unacceptable voids.

1040.3.3.3 Steel guard rail posts and guard cable posts, blocks, post connectors anchor plates, soil plates, and steel tube for breakaway cable and end section may be accepted on the basis of an acceptable Fabricator's Certification and field inspection. If a Fabricator's Certification is not provided, a mill test report shall be furnished. Regardless of the type of documentation, field inspection shall be performed and shall consist of checking the Fabricator's Certification or mill test report; checking dimensions and fabrication; weight [mass] per linear foot [meter]; and weight [mass] of coating. It will only be necessary to submit samples to the Laboratory when requested by *Construction and Materials*, or when field inspection indicates questionable compliance with the specifications. When samples are taken, they shall be taken at the size

and frequency shown in Field Section FS-1040 Table 2 of this Manual. The number of specimens selected for field inspection should never be less than three.

1040.3.3.3.1 An acceptable Fabricator's Certification should indicate the source of supply, grade of structural steel, number of pieces, size, heat or mill order number, and a statement that the material was galvanized in accordance with AASHTO M111. The heat or mill order number is to be such that mill tests may be obtained from the fabricator when desired. The Fabricator's Certification is to be signed by an authorized representative of the fabricator and it need not be notarized. An acceptable mill test report shall show size and quantity, grade of steel, heat or mill number, complete physical results, complete chemical analysis, and shall include or have attached a certification statement that the material was galvanized in accordance with AASHTO M111 and results of tests performed to determine weight [mass] of coating.

1040.3.3.3.2 Dimensions of steel posts, blocks, and brackets; and weight [mass] of posts and blocks are to be as shown on the plans. Size and spacing of holes should be measured.

1040.3.3.3.3 Weight [mass] per linear foot [meter] on posts and blocks is obtained by weighing to the nearest 0.1 lb. [45 g] and dividing by the measured length. A weight [mass] tolerance of ±2.5 percent from the specified weight [mass] is allowed on posts and blocks. If test results indicate the weight [mass] to be below the specified limit, the theoretical weight [mass] should be calculated by adding the weight [mass] of steel that has been punched out to form holes and deducting the theoretical weight [mass] of galvanizing. An example of this type calculation may be found in Field Sec 1044 of this Manual.

1040.3.3.3.4 Field determination of weight [mass] of coating is to be made on a minimum of 10 percent of the lots of material furnished. Test procedures and conditions of acceptance or rejection shall be as described in paragraph 1040.3.1.4 of this section except a smaller number of single-spot test results would be acceptable on steel blocks and post connectors.

1040.3.4 Guard Cable and Fittings. Guard cable and fittings are to be accepted by certification, if applicable, accompanied by field inspection and sampling if necessary. Field inspection is to consist of an examination of certifications, checking dimensions and fabrication, and weight of coating. Samples shall be submitted when requested by the State *Construction and Materials* Engineer, when field inspection indicates questionable compliance; or when the item is of a size or shape that weight [mass] of coating cannot be determined by magnetic gauge.

1040.3.4.1 Certifications are required for the cable, eyebolts, turnbuckles, and clips for cable-to-cable connections. Certifications are to contain a statement that material furnished was manufactured to conform to the requirements of the applicable ASTM or AASHTO Specifications specified in Specification Sec 1040. Certifications are not required on other items.

1040.3.4.2 Dimensions and fabrication are to be as shown on the plans.

1040.3.4.3 Field determination of weight [mass] of coating may be determined on nearly all fittings but not on cable. Samples of cable are to be taken at the frequency and of the size shown in Field Section FS-1040 Table 2 of this Manual. Test procedures for determining weight [mass] of coating and conditions of acceptance or rejection for items other than cable is to be as described in paragraph 1040.3.1.4 of this Section.

1040.4 REPORT. SiteManager is to be used to identify samples sent to the Laboratory and to create the inspection report. The report is to indicate acceptance, qualified acceptance, or rejection. If a sample is submitted to the Laboratory for testing, the Laboratory will perform the designated tests and complete the SiteManager record. If all tests are performed and acceptance is made in the field, the inspector should complete the entire report.